

**WHAT IS CLAIMED IS:**

1. A method of high throughput and quantitative processing of microarrays of biological or chemical material on substrates, comprising the steps of:

simultaneously transporting a plurality of said substrates at a predetermined speed on a movable surface;

dispensing at least one tagged reagent onto said substrates in the form of an aerosol mist; and

incubating said substrates under conditions that promote reaction between said tagged reagent and said biological or chemical material while said substrates are on said movable surface.

2. The method of Claim 1, wherein said step of simultaneously transporting a plurality of said substrates comprises the step of transporting said substrates on a conveyor.

3. The method of Claim 1, wherein said step of simultaneously transporting a plurality of said substrates comprises the step of transporting said substrates on a platform.

4. The method of Claim 1, comprising the further step of forming said microarrays on said substrates prior to said simultaneously transporting step.

5. The method of Claim 4, wherein the microarrays are DNA microarrays.

6. The method of Claim 4, wherein the microarrays are protein microarrays.

7. The method of Claim 1, comprising the further step of dispensing a blocking reagent on said substrates in the form of an aerosol mist.

8. The method of Claim 1, comprising the further step of dispensing a wash reagent on said substrates in the form of an aerosol mist.

9. The method of Claim 1, comprising the further step of blowing air on said substrates to dry said substrates.

10. The method of Claim 1, comprising the further step of analyzing said substrates using a laser after said step of incubating said substrates.

11. An apparatus for in-line processing of high density microarrays of DNA material on a plurality of substrates, comprising:

a conveyor for providing continuous indexing motion to said substrates while a series of assaying processes are performed at predetermined positions along said conveyor;

a plurality of workstations, each of said workstations adapted to perform at least one of said assaying processes;

a fluid transfer device positioned at a predetermined position along said conveyor, comprising:

a dispenser mounted on a motion head and adapted to aspirate programmable volumetric amounts of reagents from a source and to dispense programmable volumetric amounts of said reagents in the form of a spray on said substrates to uniformly coat said substrates;

a positive displacement pump serially connected to said dispenser for metering the aspiration and dispensing of said reagents; and

a heating system positioned at a predetermined position along said conveyor and downstream of said fluid transfer device for incubating said substrates as they are transported on said conveyor.

12. The apparatus of Claim 11, wherein said conveyor comprises a walking beam conveyor.

13. The apparatus of Claim 11, wherein said positive displacement pump comprises a syringe pump.

14. The apparatus of Claim 11, wherein said heating system comprises a blower to convectively incubate said substrates.

15. The apparatus of Claim 11, wherein said heating system comprises an infrared (IR) lamp to radiatively incubate said substrates.

16. The apparatus of Claim 11, wherein said heating system comprises a heater to conductively incubate said substrates.

17. The apparatus of Claim 11, further comprising an arraying machine for forming said microarrays on said substrates.

18. A system for the batch processing of arrays of biological or chemical material, comprising:

a plurality of substrates with each substrate having an array of said biological or chemical material thereon;

a motion platform having an array of said substrates housed thereon; and

a dispenser mounted on an X, X-Y or X-Y-Z robotic head for serially dispensing predetermined quantities of reagents on said substrates and comprising a first passage for dispensing reagents onto said substrates and a second passage for blowing air on said substrates to dry said substrates.

19. The system of Claim 18, wherein said biological material comprises DNA.

20. The system of Claim 18, wherein said biological material comprises proteins.

21. The system of Claim 18, further comprising a direct current fluid source hydraulically coupled to said dispenser to meter precise dispensing of said reagents from said dispenser.

22. The system of Claim 18, further comprising a positive displacement pump hydraulically coupled to said dispenser to meter precise dispensing of said reagents from said dispenser.

23. The system of Claim 18, further comprising a plurality of said dispensers for parallelly dispensing predetermined quantities of reagents on said substrates.

24. An apparatus for transferring a liquid from a source to a target, comprising:

an aspirate-dispense device, comprising:

a first passage having an orifice at one end for aspirating liquid into said first passage and dispensing said liquid from said first passage;

a second passage adapted for the flow of pressurized air for mixing with said liquid dispensed from said first passage to form an aerosol mist; and

a miniaturized tip formed at said orifice and insertable in receptacles for aspirating said liquid to be transferred; and

a positive displacement pump in fluid communication with said first passage for metering predetermined quantities of said liquid into and out of said orifice.

5        25.    The apparatus of Claim 24, wherein said tip has an outer diameter between about 500  $\mu\text{m}$  and about 2000  $\mu\text{m}$ .

26.    The apparatus of Claim 24, wherein said tip has an inner diameter between about 50  $\mu\text{m}$  and about 250  $\mu\text{m}$ .

27.    The apparatus of Claim 24, wherein said tip has a length between about 1 mm to about 10 mm.

10       28.    The apparatus of Claim 24, wherein said tip is formed from a ceramic.

29.    The apparatus of Claim 24, wherein said tip is formed from alumina.

30.    A method of transferring a liquid from a source to a target using an aspirate-dispense device having a first passage connected to a metering pump and a second passage connected to a pressurized air reservoir, said first passage having a tip at one end, said method comprising the steps of:

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         inserting said tip of said device in said liquid in said source;

         aspirating a predetermined quantity of said liquid into said first passage of said device by operating said pump;

         positioning said tip of said device over said target; and

20       dispensing a predetermined quantity of said liquid onto or into said target in the form of an aerosol mist by operating said pump and mixing said liquid with air flow from said reservoir.

31.    A carrier for holding a plurality of slides through a series of assaying processes, comprising:

25       a plurality of nests with each said nest being sized and configured to receive one of said slides;

         a plurality of clamps for securing said slides in said nests, each said clamp being positioned at an end of each said nest; and

30       each said nest comprising a through cavity such that when said slides are loaded in said nests, the upper and lower surfaces of said slides are exposed for

forming and processing of microarrays of biological or chemical material thereon.

32. The carrier of Claim 31, further comprising a lip to facilitate in aligning a stack of said carriers.

5 33. The carrier of Claim 31, further comprising a readable code to identify said carrier.

34. The carrier of Claim 31, wherein said carrier comprises anodized aluminum.

10 35. The carrier of Claim 31, wherein said carrier has a footprint of about 127 mm × 85 mm.

36. A method of transporting a plurality of substrates in a cassette through a series of workstations, each of said workstations adapted to form or process biological or chemical microarrays on said substrates, said method comprising the steps of:

15 seating said substrates in a plurality of compartments formed in said cassette, each said compartment having a through hole so that the upper and lower surfaces of said substrates are accessible for forming or processing said microarrays thereon;

securing said substrates in said compartments using a plurality of clamps, each said clamp being positioned at an end of each said compartment; and

20 transporting said substrates in said cassette through said workstations by one or more movable surfaces.